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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : G11B 7/26, 7/24, 23/03, 33/14

A2

(11) International Publication Number: **WO 99/14748**

(43) International Publication Date: 25 March 1999 (25.03.99)

(21) International Application Number: PCT/NL98/00523

(22) International Filing Date: 10 September 1998 (10.09.98)

(30) Priority Data:
08/928,063 12 September 1997 (12.09.97) US

(71) Applicant *(for all designated States except US)*: ODME INTERNATIONAL B.V. [NL/NL]; De Run 4315, NL–5503 LP Veldhoven (NL).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: CUBIT, Robert, Leslie [US/US]; 14332 Locust Street, Westminster, CA 92683 (US).

(74) Agent: VAN KAN, J., J., H.; Algemeen Octrooibureau, World Trade Center, Pastoor Petersstraat 160, NL–5612 LV Eindhoven (NL).

(81) Designated States: AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), EE, EE (Utility model), ES, FI, FI (Utility model), GB, GE, GH, GM, HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
Without international search report and to be republished upon receipt of that report.

(54) Title: SEALED ENCLOSURE FOR SHIPPING, STORING AND RECORDING AN OPTICAL DISC MASTER

(57) Abstract

A recording cover that provides a clean air distribution and micro cleanroom environment for recording of optical disc masters, while concomitantly serving the purpose of protecting the sensitive optically active lamina during transportation and storage of the optical disc substrate. A rigid, opaque, and reusable recording cover concentrically and fixedly, yet removably, fits over the optically active lamina of a disc substrate and creates an enclosed contaminate free space therebetween. The recording cover has a plurality of inwardly located air entrance cavities and a plurality of circumferentially located air exit holes, whereby clean and dry air is introduced into the air entrance cavities. The clean, dry air flows through the enclosed space and out of the exit holes under positive air pressure and centrifugal force during the recording phase. The air pressure flow, in conjunction with centrifugal force, removes both ablative and also spurious environment debris particles from the enclosed space, thereby preventing occlusion of recorded data pits on the optically active lamina by debris particles.

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SEALED ENCLOSURE FOR SHIPPING, STORING AND RECORDING AN OPTICAL DISC MASTER

BACKGROUND OF THE INVENTION:

FIELD OF THE INVENTION:

The invention relates to the art of making an optical disc master from which thousands of identical discs may be made, and more particularly to an apparatus for utilizing an optical disc recordable substrate, in conjunction with a rigid and reusable positive air flow recording cover, enclosure, to create a disc shaped self contained cleanroom environment for optically writing high density information upon said disc, whereby, during the writing process, the optically active lamina of said disc substrate is protected from both ablative and spurious microscopic environmental debris particles, that might occlude recorded data pits of information on the disc master surface, by a continuous outward flow of clean dry air. A slight modification of the recording cover yields a second similar but sealed cover to ship the recording cover and attached disc substrate to and from the recording process.

DISCUSSION OF THE PRIOR ART:

Optical disc masters are articles from which all pre-recorded mass produced consumer optical discs, e.g. compacts discs and video discs, are subsequently molded. Historically, methods of producing optical disc masters employed a relatively large, complex, heavy and highly stable precision and reusable glass based turntable apparatus operating in a large and expensive to maintain cleanroom environment.

Alternate recording methods have been developed that place a protective cover over an optical disc recording substrate during the writing/recording process to eliminate the need for the massive equipment and large clean room environment; however, because information is conventionally recorded by modulating a laser beam to form pits along tracks on the disc, the resulting ablated particles tend to obscure the pits and thereby decrease writing sensitivity.

One example lies in U.S. patent 4,519,061, issued to Dahneke et al., which discloses a

method for recording with a sealed disc unit wherein the resulting ablated particles are retained within the interspace between the disc and the cover. Although Dahneke discloses an elaborate, intricate, and complex scheme to maintain a temperature gradient between the disc surface and the protective cover to develop a thermophoretic particle-driving force to remove debris particles from the disc's surface, ablated particles are still confined within the disc and cover interspace and still potentially if not actually occlude data pits.

Another example is illustrated in U.S. patent 4,539,573, issued to Marchant et al., which discloses placement of vent openings upon a cover sheet over the recordable substrate disc to allow a radial air flow, created by centrifugal force of the spinning disc, to disperse the ablated debris within the disc and cover interspace. However, because the location of the exit holes on the cover are placed perpendicular in relation to the disc and the laminar air flow, therefor the apparatus is not conducive to proper removal of ablated debris particles.

Yet another adaptation, U.S. patent 4,583,213, issued to Bracken et al., discloses a stationary air shroud, which is placed above a spinning disc substrate. Air is introduced into the disc and shroud interspace in a direction of flow which is perpendicular to the plane of the spinning disc, thus causing air turbulence and vibration in the disc. Turbulence and vibration are negative attributes not conducive to the micrometer precision required for laser recording. In addition, the air is expelled through a gap between the air shroud and the disc's outer edge, wherein the path of expulsion is also perpendicular to the air flow plane. In addition, Bracken utilizes a flange at the outer edge of the air shroud to produce back pressure and reduce radial air flow, thereby, reintroducing undesirable ablated debris particles back into the disc and cover interspace.

The construction and maintenance of early optical disc mastering cleanroom environments was in itself large, cumbersome, and expensive, making manufacture of optical disc masters a costly venture. The more recent art of utilizing the protective covers on the discs substrates in a disc confined environment has proved, however, to be less than effective in removing all spurious and ablated particles from the disc/cover interspace. Therefore, there remains a long standing and continuing need for an advance in the art beyond the existing art of mastering optical discs that is

7/21/06, EAST Version: 2.1.0.11

simpler in both design and use and more economical and efficient in its construction and use.

SUMMARY OF THE INVENTION:

It has been discovered that effective and efficient recording of optical disc masters is possible in a portable, disc sized, self contained cleanroom environment as disclosed in the present invention. In a primary environment, the invention consists of a pregrooved (tracking groove) planar disc having an optically active lamina deposited on the grooved surface. The active lamina is covered and enclosed by an optically opaque shipping cover such that a space is maintained between the active lamina and the inner surface of said shipping cover. A flexible band is disposed around the periphery of the juxtaposed edges of the disc master and the disc cover and by slightly overlapping both disc and cover thereby seals the interior space from contaminants and securely holds disc master and disc cover together during shipment. The underside of said disc is protected by an opaque, rigid, yet removable, carrying tray having a spindle which fits into the central hole of said disc and the concentric central hole of the shipping cover. The entire structure may then be enclosed in an opaque and impervious bag to further inhibit degradation of the optically active lamina by ambient light, thereby, providing a longer disc substrate storage life.

During recording, the disc substrate/master is removed from its opaque shipping container by removing the flexible band. A similarly shaped reusable recording cover is then placed concentrically upon said disc and the flexible band reapplied, whereby a disc and cover interspace is maintained. Said recording cover is designed with a plurality of inner air entrance holes disposed around the spindle point and a plurality of circumferential air outlet holes, wherein a pre-filtered clean, and dry airflow is maintained into the inner holes and out of the circumferential holes not only by centrifugal force of the spinning disc and cover but also by the positive laminar airflow pressure passing through the disc/cover interspace from center to periphery. At least three alternate embodiments are described and claimed herein that utilize the recording cover and shipping cover conjunctively rather than sequentially in the shipping, recording and storing processes.

OBJECT OF THE INVENTION:

It is therefore a primary object of this invention to create a process for making an optical

7/21/06, EAST Version: 2.1.0.11

disc master in a disc-sized microenvirnoment which frees the recording process from having to take place in a traditionally large, cumbersome, and expensive cleanroom environment.

It is a further object of this invention to make an optical disc master by enclosing the active surface of an optical disc with a disc cover and having a laser beam pass through the other side of the disc substrate to form pits in the optically active lamina, by either ablating or by consuming the optically active lamina, while keeping the lamina surface free of particulate matter.

Another object of the invention is to provide a compact, lightweight, sealed assembly, protective cover for unrecorded optical disc substrates and recorded optical disc masters thus simplifying and reducing the cost of storing, shipping and handling of optical recording disc substrates.

Another object of the invention is to provide a cover that protects the optically active lamina of the disc from being contaminated by ambient debris and other impurities both during shipping and recording.

A further object of the invention is to provide a method for continuous removal of ablated particles encountered during the recording process from the optically active lamina by means of an unobstructed positive air flow through the disc enclosure and over the disc substrate to prevent the ablated particles from interfering with a writing or reading laser beam; spurious particles would necessarily decrease writing sensitivity and reading fidelity.

Yet another object of the invention is to prevent ambient light from contaminating the optically active lamina by chemically decomposing and thereby degrading the dye polymer of the optically active lamina. Thus an optical recording disc substrate is given a longer shelf life before losing its active and proper response to laser light.

It is a further object of this invention to create a process in which optical disc mastering can be accomplished with a vastly reduced cost for capital equipment and can be accomplished in a manner that is significantly less time consuming than the methods that are presently employed.

It is a further object of this invention to create a method of recording optical disc masters in an inexpensive, disposable, micro-clean environment, and thus avoid the use of expensive cleanroom technology at the time the recordings for the optical disc masters are made.

7/21/06, EAST Version: 2.1.0.11

BRIEF DESCRIPTION OF THE DRAWINGS:

Figure 1. is a disassembled perspective view of the optical disc substrate recording enclosure cover, disclosing the recording cover, optical disc substrate, first attaching means, spindle spongy adhesive ring, and the recording optical laser beam.

Figure 2. is a cross-section of the assembled invention of Figure 1 taken along line 2--2 of Figure 1, and illustrates laser ablation of active layer and positive airflow over the spinning disc.

Figure 3. is a detailed plan, top view of the recording cover (actual size).

Figure 3a. is a detailed elevation, side view of the recording cover (actual size).

Figure 4. is a disassembled perspective view of a preferred embodiment of the disc substrate shipping enclosure, disclosing the shipping cover, the optical disc substrate, a first attaching means, spindle spongy adhesive ring, and the carrying tray.

Figure 5. is a cross-section of the assembled invention of Figure 4 taken along line 5--5 of Figure 4.

Figure 6. is a disassembled perspective view of a second alternative shipping enclosure embodiment, disclosing the recording cover with a cutaway view of a peelable protective layer sealant, the optical disc substrate, first attaching means, spindle spongy adhesive ring, and a carrying tray.

Figure 7. is a cross-section of the assembled invention of Figure 6 taken along line 7--7 of Figure 6.

Figure 7a. is a magnified view of the encircled spindle hole section of Figure 7.

Figure 8. is a disassembled perspective view of a third alternative shipping enclosure embodiment, disclosing the shipping cover, with central and peripheral adhesive linings, recording cover, optical disc substrate, first attaching means, spindle spongy adhesive ring, and the carrying tray.

Figure 9. is a cross-section of the assembled invention of Figure 8 taken along line 9--9 of Figure 8.

7/21/06, EAST Version: 2.1.0.11

Figure 10. is a disassembled perspective view of a fourth alternative shipping container embodiment, disclosing the shipping cover, second attaching means, recording cover, optical disc substrate, first attaching means, spindle spongy adhesive ring, and the carrying tray.

Figure 11. is a cross-section of the assembled invention of Figure 10 taken along line 11-11 of Figure 10.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT:

The following is a description of the best mode of implementing the concept of the invention. This description is given only to illustrate the general principles of the invention and is not to be interpreted in a limiting sense. The true scope and further extent of the invention can only be ascertained by an interpretation of the appended claims in light of the overall specification.

Figures 1, 2, 3 and 3a illustrate a preferred embodiment of the recording process of the invention, wherein the invention utilizes a clean, pre-grooved, unrecorded, optical disc substrate 33, a reusable recording cover 46, a first attaching means 38, and a spindle spongy adhesive ring 39. Optical disc substrate 33 is preferably made of a polycarbonate material such that optical disc substrate 33 is transparent to incident light of a red laser of approximately 780nm, wherein substrate 33 has an index of refraction of approximately 1.5. Optical disc substrate 33 has a top side 32, a bottom side 34, an inner spindle portion 35 which defines a central spindle orifice 26, an outer portion 37, and a spiral tracking groove 36 superimposed on the topside 32. An optically active lamina 31 is spin coated over top side 32 and spiral tracking groove 36. Optically active lamina 31 is an optically active solution conventionally consisting of HITC (cyanine-iodide) dye solute, Nitrocellulose solute, BCS (butylcellosolve) solvent, and methanol solvent of 5%, in a reactive concentration to allow reaction to incident light energy from a near infra red laser, wavelength of approximately 780nm, wherein disc substrate 33 has an index of refraction of approximately 1.5.

Recording cover 46 is a substantially rigid disc shaped member, and preferably consisting of an ABS polymer, but may be metallic, glass, or virtually any lightweight opaque substance. Recording cover 46 has a bottom face 50, a top face 48, an inner wall 56 which defines a central

7/21/06, EAST Version: 2.1.0.11

spindle orifice 26, and a peripheral wall 58. Inner wall 56 further defines a plurality of 15 inner air inlet apertures 54 equidistantly positioned at 24° intervals along inner wall 56, as more clearly illustrated in Figure 3. Peripheral wall 58 defines a plurality of 30 peripheral air exit apertures 52 equidistantly positioned at 12° intervals along peripheral wall 58, again more clearly illustrated in Figure 3.

A first attaching means 38 is configured to snugly fit around the periphery of recording cover 46 and disc substrate 33 on assembly. Attaching means 38 may be made of any flexible polymer of a "U" shaped cross section to firmly but removable fit over the edge of cover 46 and substrate 33 to hold cover 46 fixedly engaged with disc substrate 33 as indicated in Figure 2.

When an optical disc master is to be made or recorded, bottom face 50 of recording cover 46 is concentrically placed over top side 32 of disc substrate 33, such that a first space 51 is enclosed therein. Inner wall 56 of recording cover 46 removably adheres to the inner portion 35 of disc substrate 33 via a spindle spongy adhesive ring 39, thereby defining a sealed concentric central orifice 26. Peripheral wall 58 of recording cover 46 is likewise fixedly, yet removably, attached to outer portion 37 of optical disc substrate 33 via first attaching means 38. First attaching means 38 is preferably made of a molded silicon rubber ring having a "U" shaped cross section to receive the rim of outer portion 37 and peripheral wall 58, thereby maintaining the structure in an assembled position during recording. Central orifice 26 receives a spindle from a writing apparatus (not shown) which rotates/spins disc substrate 33 together with attached recording cover 46 at a rate of approximately 200 to 600 rpm rotational velocity.

During recording, a data modulated laser source 64, being of sufficient wavelength to pass through the transparent disc substrate 33, is finely focused to the sub-micron level on optically active lamina 31. The data modulated laser source 64 is caused to follow spiral tracking groove 36 to form data pits along the spiral track (not shown) in optically active lamina 31 by ablation. In the pit formation process, particulate material of micron size or so will be exploded into space 51 of the enclosure. To prevent these ablated particles which are created during recording and other foreign matter in first space 51 from occluding the data pits, a pre-filtered, clean, and dry airflow 53 is forcefully introduced through inner apertures 54 of recording cover 46 into first

7/21/06, EAST Version: 2.1.0.11

space 51. The pre-filtered airflow 53 continues through first space 51 and exits through peripheral apertures 52, carrying with it ablated and foreign particulate matter forced out of peripheral apertures 52 by both centrifugal force and the positive laminar airflow pressure. The airflow is maintained at a preferable rate of 30 cubic feet per hour, at less than 10 percent humidity, and is insured to exclude particulate on the order of 0.2 microns or larger from first space 51. The need to maintain a clean environment surrounding the optically active lamina 31 is essential to precisely and accurately record data thereon, not only during the recording process, but also before and after recording while in transfer and in storage; therefore, the clean and protective environment must begin and end with the shipping and storage phase of disc substrate 33.

As a result of the sensitivity to degeneration of the binder dye present in optically active lamina 31 to ambient light as well as contamination due to particulate matter landing thereon, a unique shipping enclosure was created to protect disc substrate 33 and optically active lamina 31 from degeneration, contamination and damage during transportation and storage, as illustrated in Figures 4 and 5. The shipping enclosure seals and encloses disc substrate 33, with a shipping cover 19, first attaching means 38, spindle spongy adhesive ring 39, and a carrying tray 41. Shipping cover 19 preferably consists of an ABS polymer, but may be metallic, plastic or similar non transparent substance. Shipping cover 19 has an upper side 20, a lower side 28, an internal wall 24 which defines central orifice 26, and a circumferential wall 22. Lower side 28 of the opaque shipping cover 19 is placed concentrically over the top side 32 of disc substrate 33, thereby creating a spatial cavity 30 therebetween. Internal wall 24 removably attaches at its lower rim to inner portion 35 of disc substrate 33 by means of spindle spongy adhesive ring 39 such that central orifice 26 is concentrically defined by both cover 19 and substrate 33. Circumferential wall 22 is held fast to outer portion 37 of disc substrate 33 via first attaching means 38. First attaching means 38 is preferably a molded silicon rubber ring having a "U" shaped cross section to receive outer portion 37 and circumferential wall 22, thereby imperviously, yet removably, sealing and binding the outer portion 37 to circumferential wall 22.

Once substrate 33 and enclosure cover 19 are coupled together by first attaching means 38

7/21/06, EAST Version: 2.1.0.11

the disc substrate and enclosure cover assembly is inserted into carrying tray 41 where the bottom side 34 of disc substrate 33 is protected by carrying tray 41. Carrying tray 41 is preferably made of an ABS polymer, but may also be made of metal, plastic, or other similarly opaque and rigid material. Carrying tray 41 has a fringe 40 and a centrally located mounting spindle 42, whereby spindle 42 is inserted into central orifice 26 to maintain the optical disc substrate 33 and shipping cover 19 in a stationary position during transportation and storage. Fringe 40 of carrying tray 41 seats first attaching means 38 peripherally therein, thereby shielding bottom side 34 of disc substrate 33 from damage and debris. To further protect disc substrate 33 from damage and debris, disc substrate 33, shipping cover 19, first attaching means 38, and carrying tray 41 may then be enclosed in an opaque and optically reflective hermetically sealed bag (not shown) to allow for safe transportation of the disc and to extend its shelf life.

Upon arrival at a customer who wishes to make an optical disc master, a blank (unrecorded) disc substrate 33 is removed from the sealed bag and carrying tray 41. First attaching means 38 is disconnected from circumferential wall 22 of shipping cover 19 and outer portion 37 of disc substrate 33. Shipping cover 19 is then removed and replaced by recording cover 46. First attaching means 38 is then replaced onto the peripheral wall 58 of recording cover 46 and outer portion 37 of disc substrate 33. Recording of the optical disc master may now proceed by placing the disc substrate 33 and recording cover 46 assembly upon a spindle emanating from a recording apparatus (not illustrated), as delineated above.

Although there has been described herein above a suitable sealed, protective shipping and storing enclosure, there are at least three alternative variations of the shipping and storing enclosure configuration. Alternate shipping embodiments have been designed in order to simplify the transition from the shipping phase to the recording phase.

One alternate cost efficient and simple shipping and storage embodiment, illustrated in Figures 6, 7 and 7a, consists of a protective layer 62, recording cover 46, disc substrate 33, first attaching means 38, spindle spongy adhesive ring 39, and carrying tray 41. Protective layer 62 is preferably made of a relatively thin common shrink wrap opaque plastic material with removable adhesive qualities that occludes light waves within the range that would degenerate optically

7/21/06, EAST Version: 2.1.0.11

active lamina 31. Removable protective layer 62 adheres to top face 48 of recording cover 46, and imperviously covers the entire surface of top face 48, including the peripheral apertures 52 and outer wall 58 and inner apertures 54 and inner wall 56 in a tight fitting tent like manner, thus maintaining a particulate free environment within first space 51. The base, circular rim of inner wall 56 of recording cover 46 removably connects via spindle spongy adhesive ring 39 with inner portion 35 of disc substrate 33, and the rim of peripheral wall 58 of recording cover 46 lies flat along outer portion 37 of optical disc 33. Peripheral wall 58, and outer portion 37 are removably yet snugly engaged by first attaching means 38 applied around the periphery thereof as discussed above. The entire unit is then placed onto carrying tray 41, as described above in the first shipping embodiment, and then enclosed in an opaque and optically reflective bag (not shown) to allow for safe transportation and to extend the shelf life of disc substrate 33.

During recording of an optical disc master, protective layer 62 and carrying tray 41 would first be removed. Recording cover 46 and disc substrate 33 are then secured together by spindle spongy adhesive ring 39 and first attaching means 38 as described above. The recording assembly is then placed on a spindle of the recording apparatus to allow recording to proceed as described above.

To further protect recording cover 46 and disc substrate 33 in transit and in storage a third shipping and storage enclosure and method was devised by placing a shipping cover 19 over recording cover 46 as illustrated in Figures 8 and 9. This shipping embodiment enables yet greater protection for recording cover 46 and disc substrate 33. The third shipping embodiment consists of a shipping cover 19 with a peripheral spongy ring of removable adhesive material 60 in addition to the spindle spongy adhesive ring 39 in other embodiments supra. The spongy adhesives may be obtained as an off shelf item from 3M Company. Shipping cover 19 is superimposed on the upper rim of peripheral wall 58 of recording cover 46, which in turn covers disc substrate 33. First attaching means 38, in turn wraps around the periphery and binds together recording cover 46 and substrate 33, which combination is seated in carrying tray 41, as illustrated in Figures 8 and 9. First attaching means 38 secures peripheral wall 58 of recording cover 46 and outer portion 37 of disc substrate 33, after which they are all placed upon carrying

7/21/06, EAST Version: 2.1.0.11

tray 41 as detailed above. Circumferential wall 22 of shipping cover 19 has a peripheral spongy adhesive material 60 disposed on the bottom side thereon, whereby adhesive material 60 is caused to removably connect with an exterior top side 90 of first attaching means 38. Thus circumferential wall 22 of shipping cover 19 is removably attached to concentrically lie juxtaposed and cover peripheral wall 58 of recording cover 46. Spindle spongy adhesive ring 39, on bottom side of internal wall 24 of shipping cover 19, concentrically attaches to the top side of inner wall 56 of recording cover 46 an thereby occludes inner apertures 54, thereby defining a second space 49 between the lower side 28 of shipping cover 19 and top face 48 of recording cover 46. The entire unit is fixedly secured in place by first attaching means 38 and is removably seated in tray 41 which in turn is placed into an opaque and optically reflective hermetically sealed bag (not shown) to allow for safe transportation of the disc substrate 33 and to extend its shelf life.

Referring now referring to Figures 10 and 11, a fourth shipping and storage embodiment is disclosed utilizing and incorporating recording cover 46. The shipping embodiment at bar consists of a second attaching means 44, shipping cover 19, recording cover 46, disc substrate 33, first attaching means 38, spindle spongy adhesive ring 39, and carrying tray 41. First attaching means 38 is, as above, configured to engage peripheral wall 58 of recording cover 46 and the bottom side of outer portion 37 of disc substrate 33 as detailed above. Shipping cover 19 is concentrically placed over recording cover 46 such that bottom side of circumferential wall 22 of shipping cover 19 rests upon exterior top side 90 of first attaching means 38, and the bottom of internal wall 24 of shipping cover 19 contacts the top side of inner wall 56 of recording cover 46. Top side of circumferential wall 22 of shipping cover 19, peripheral wall 58 of recording cover 46, outer portion 37 of disc substrate 33, and first attaching means 38 are all further encompassed by second attaching means 44. Second attaching means 44 is preferably a molded silicon rubber ring having a "U" shaped cross section and of sufficient size to receive circumferential wall 22, peripheral wall 58, outer portion 37, and first attaching means 38. The entire unit is then placed in a carrying tray 41, as detailed above, such that second attaching means 44 rests within fringe 40 of carrying tray 41. To further protect disc substrate 33, the unit is then placed into an opaque and optically reflective hermetically sealed bag (not shown) to allow for safe transportation of the

7/21/06, EAST Version: 2.1.0.11

disc substrate 33 and to extend its shelf life.

In all shipping embodiments that enclose recording cover 46, shipping cover 19 is removed by detaching adhesive material 39 and 60 and by removing second attaching means 44 prior to recording data. After further removing carrying tray 41, the recording assembly comprising recording cover 46, and disc substrate 33 coupled together by first attaching means 38 is placed on the spindle of the recording apparatus (not shown) and recording proceeds as described above to make the disc master.

While the invention herein disclosed has been described by means of a specific embodiment and application thereof, numerous modifications, and variations could be made thereto by those skilled in the art without departing from the spirit and scope of the present invention. Accordingly, the scope of the invention should be determined not by the embodiments illustrated, but by the appended claims and their legal equivalents.

7/21/06, EAST Version: 2.1.0.11

CLAIMS

What is claimed is:

1. A portable micro-cleanroom environment and evenly distributed forced air system used in the recording phase of optical disc mastering, comprising:

a transparent optical disc having a top side and a bottom side, wherein said top side comprises a writing surface; said optical disc also having an outer portion and an inner portion, wherein said inner portion defines a central spindle orifice;

a recording cover having a top face and a bottom face, said recording cover having an inner wall and a peripheral wall; said inner wall defining a central spindle orifice and said inner wall further defining a plurality of inner apertures for air entrance; said peripheral wall defining a plurality of peripheral cavities for air exit; said bottom face of said recording cover being disposed over said top side of said optical disc, thereby defining an enclosed space therebetween; said inner wall of said recording cover removably forming an air tight attachment to said inner portion of said disc to concentrically define said central spindle orifice;

a first airtight attaching means engaging said peripheral wall of said recording cover and said outer portion of said optical disc.

2. The invention of claim 1, wherein said writing surface of said optical disc is comprised of an optically active lamina disposed upon said top side of said optical disc, whereby a laser beam of sufficient wavelength can pass through the bottom side of said optical disc and be focused upon said optically active lamina on the other side of said disc substrate and thereby record data on said lamina.

3. The invention of claim 1, wherein said optical disc has a tracking groove disposed on said top side to enable a laser beam to follow said groove to record information on said optical disc along said groove.

4. The invention of claim 1, wherein a clean laminar air-flow is introduced into said inner

7/21/06, EAST Version: 2.1.0.11

apertures under pressure and exits through said peripheral cavities of said cover, whereby said laminar air flow removes all ambient and ablated debris from said space between said bottom face of said recording cover and said top side of said optical disc, thereby providing a clearer recording by prohibiting settlement of debris upon and into recorded data in said lamina.

5. The invention of claim 1, wherein said recording cover is comprised of a sufficiently rigid and opaque material to allow repeated recordings with other optical discs.

6. The invention of claim 1, wherein said first attaching means is comprised of a flexible ring having a "U" shaped cross section to wrap around and fixedly attach an outer periphery of said recording cover to an outer periphery of said optical disc substrate along their circumference.

7. A method for recording optical disc masters in a portable micro cleanroom environment and evenly distributed, forced air system, comprising the steps of:

providing a transparent optical disc having a top side, a bottom side, an inner portion and an outer portion, a writing surface disposed upon said top side, and a spindle orifice centrally disposed in said inner portion;

providing a recording cover having a top face, a bottom face, an inner spindle wall creating a central spindle orifice and a plurality of inner air entrance apertures defined by said inner wall; and an outer peripheral wall creating a plurality of peripheral air exit cavities in said peripheral wall; disposing said bottom face of said recording cover over said top side of said optical disc to define an enclosed space therebetween; attaching said inner wall of said recording cover to said inner portion of said disc to concentrically define said central spindle orifice;

providing an air tight attaching means to engage said peripheral wall of said recording and said outer portion of said optical disc,

introducing a clean and dry air pressure flow into said plurality of inner air entrance apertures, said air exiting out of said peripheral air exit cavities, thereby removing debris from said enclosed space.

8. Apparatus for safely and cleanly shipping optical discs which are to be used in the

7/21/06, EAST Version: 2.1.0.11

recording phase of optical disc mastering, comprising:

a transparent optical disc having a top grooved side and a bottom planar side, wherein an optically active lamina is coated upon said top side; said optical disc also having an outer portion and an inner portion, wherein said inner portion defines a central spindle orifice;

a shipping cover disposed upon said optical disc having an internal wall and a circumferential wall, said internal wall defining a central spindle orifice; said shipping cover having an upper side and a lower side, whereby said lower side of said shipping cover is disposed over said top side of said optical disc, thereby defining a cavity therebetween; said internal wall of said shipping cover contacting and sealing said inner portion of said optical disc and said circumferential wall of said shipping cover engaging said outer portion of said optical disc;

attaching means for removably engaging the circumferential wall of said shipping cover and said circumferential wall of said outer portion of said optical disc;

a carrying tray having a fringe and a spindle, said spindle being inserted into the central orifice defined by said optical disc and said shipping cover, whereby said bottom side of said disc is disposed over said carrying tray and said attaching means contacts said fringe of said carrying tray.

9. The invention of claim 8, wherein said shipping cover and said carrying tray are comprised of a sufficiently rigid and opaque material such that said optical disc is protected from both physical damage and active layer degradation from ambient light.

10. The invention of claim 8, wherein said attaching means consists of a premolded silicon rubber ring having a "U" shaped cross section to fixedly and imperviously overlap and attach said shipping cover to said optical disc along an outer circumference thereof during transportation and storage, thereby preventing ingression of air, moisture, and ambient particles, into said cavity immediately between said optically active lamina and said shipping cover.

11. Apparatus for safely and cleanly shipping optical discs and recording covers used in

7/21/06, EAST Version: 2.1.0.11

the recording phase of optical disc mastering, comprising:

a transparent optical disc having a top side and a bottom side, wherein an optically active lamina is coated upon said top side; said optical disc also having an outer portion and an inner portion, wherein said inner portion defines a central orifice;

a recording cover having a top face and a bottom face, said recording cover having a peripheral wall and an interior wall; said interior wall defining a central orifice, and said interior wall further defining a plurality of inner apertures; said peripheral wall defining a plurality of peripheral cavities; said bottom face of said recording cover being disposed over said top side of said optical disc, thereby defining a first space;

a shipping cover having an internal wall and a circumferential wall, said internal wall defining a central orifice; said shipping cover having an upper side and a lower side, whereby said lower side of said shipping cover is placed over said top face of said recording cover thereby defining a second space;

a first attaching means removably engaging the peripheral wall of said recording cover and said outer portion of said optical disc substrate;

a second attaching means removably engaging the circumferential wall of said shipping cover and the first attaching means;

a carrying tray having a fringe and a spindle, said spindle being inserted into the central orifice defined by said optical disc, said recording cover, and said shipping cover, whereby said bottom side of said disc is disposed over said carrying tray and said second attaching means contacts said fringe of said carrying tray.

12. The invention of claim 11, wherein said internal wall of said shipping cover concentrically fits over the interior wall of said recording cover, whereby said shipping cover wall imperviously seals said inner apertures from ambient debris and prevents debris influx into said first space over said optically active lamina.

13. The invention of claim 11, wherein said circumferential wall of said shipping cover

7/21/06, EAST Version: 2.1.0.11

concentrically fits over the peripheral wall of said recording cover, whereby said shipping cover wall imperviously seals said peripheral cavities of said recording cover from ambient debris and prevents debris influx into said first space over said optically active lamina.

14. The invention of claim 11, wherein said first attaching means is comprised of a premolded silicon rubber ring and is substantially narrower than said second attaching means, whereby in conjunction, each attaching means fixedly and imperviously attach said shipping cover to both said recording cover and to said optical disc substrate along the mutual circumference thereof during transportation, thereby preventing ingression of ambient particles into said second space immediately above said recording cover.

15. The invention of claim 11, wherein said shipping cover, said recording cover, and said carrying tray are comprised of a sufficiently rigid and opaque material such that said optically active lamina is protected from both physical damage and degradation by ambient light.

16. Apparatus for shipping and storing optical discs and recording covers used in the recording phase of optical disc mastering, comprising:

an optical disc substrate having a top side and a bottom side, wherein an optically active lamina is coated upon said top side; said optical disc also having an outer portion and an inner portion, wherein said inner portion defines a central orifice;

a recording cover having a top face and a bottom face, said recording cover having a peripheral wall and an interior wall; said interior wall defining a central orifice, and said interior wall further defining a plurality of inner apertures; said peripheral wall defining a plurality of peripheral cavities; said bottom face of said recording cover being disposed over said top side of said optical disc, thereby defining a first space;

a shipping cover having an internal wall and a circumferential wall, said internal wall having a sealing adhesive means defining a central orifice, and said circumferential wall having a sealing adhesive means disposed upon the periphery thereof; said shipping cover having an upper

7/21/06, EAST Version: 2.1.0.11

side and a lower side, whereby said lower side of said shipping cover is disposed above said top face of said recording cover thereby defining a second space;

attaching means removably engaging and securing the peripheral wall of said recording cover with said outer portion of said optical disc;

said adhering means of said shipping cover removably engaging said exterior portion of said attaching means;

a carrying tray having a fringe and a spindle, said spindle being inserted into the central orifice defined by said optical disc, said recording cover, and said shipping cover, whereby said bottom side of said disc is disposed over said carrying tray and said attaching means contacts said fringe of said carrying tray.

17. The invention of claim 16, wherein said internal wall of said shipping cover concentrically fits over the interior wall of said recording cover, whereby said shipping cover imperviously seals said inner apertures from ambient debris and prevents debris influx into said first space over said optically active lamina.

18. The invention of claim 16, wherein said circumferential wall of said shipping cover concentrically fits over the peripheral wall of said recording cover, whereby said shipping cover imperviously seals said peripheral cavities of said recording cover from ambient debris and prevents debris influx into said second space over said recording cover.

19. The invention of claim 16, wherein said attaching means consists of a premolded silicon rubber ring having a "U" shaped cross section and said adhering means consists of a foamy adhesive, whereby said adhering means binds to said top exterior portion of said attaching means, and in conjunction, fixedly and imperviously attaches said shipping cover to both said recording cover and to said optical disc substrate along a mutual circumference thereof during transportation, thereby preventing ingression of ambient particles into said cavity immediately above said optically active lamina.

7/21/06, EAST Version: 2.1.0.11

20. The invention of claim 16, wherein said shipping cover, said recording cover, and said carrying tray are comprised of a sufficiently rigid and opaque material such that said optically active lamina is protected from both physical damage and degradation by ambient light.

21. Sealed apparatus for shipping, storing, and recording an optical disc master, comprising:

an optical disc substrate having a top side and a bottom side, wherein an optically active lamina is coated upon said top side, whereby data is recorded in said active lamina by laser means passing from said bottom side to said top side of said disc; said optical disc also having an outer portion and an inner portion, wherein said inner portion defines a central orifice;

a recording cover having a top face and a bottom face, said recording cover having a peripheral wall and an interior wall; said interior wall defining a central orifice, and having a plurality of inner apertures; said peripheral wall having a plurality of peripheral cavities; said bottom face of said recording cover being disposed concentrically over said top side of said optical disc, thereby defining a space therebetween;

a protective cover sheet disposed over said top face of said recording cover;

first attaching means engaging and sealing said peripheral wall of said recording cover to said outer portion of said optical disc substrate;

a carrying tray having a fringe and a spindle, said spindle being inserted into the central orifice of said optical disc substrate and said recording cover, whereby said bottom side of said disc substrate is disposed over said carrying tray and said first attaching means contacts and seals with said fringe of said carrying tray.

22. The invention of claim 21, wherein said protective cover sheet is a shrink wrap plastic material with adhesive qualities, whereby said protective sheet imperviously covers the entire surface of said top face, including said inner apertures and said peripheral cavities, and maintains a particulate free environment within said space.

7/21/06, EAST Version: 2.1.0.11

23. The invention of claim 21, wherein said recording cover and said carrying tray consist of a sufficiently rigid and opaque material such that said optically active lamina is protected from both physical damage and degradation by ambient light.

24. The invention of claim 23, wherein said attaching means consists of a premolded silicon rubber ring having a "U" shaped cross section to fixedly and imperviously attach said recording cover to said optical disc substrate along the circumference thereof during transportation, storage, and recording thereby preventing ingression of ambient particles into said space immediately above said optically active lamina.

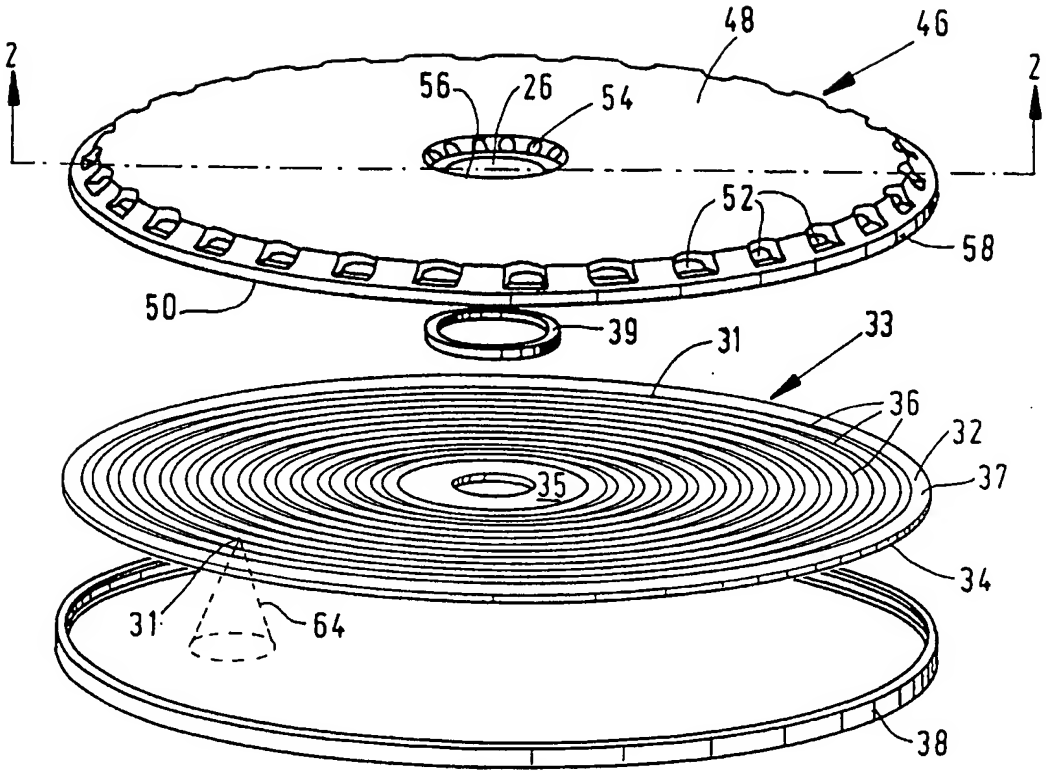

FIG. 1

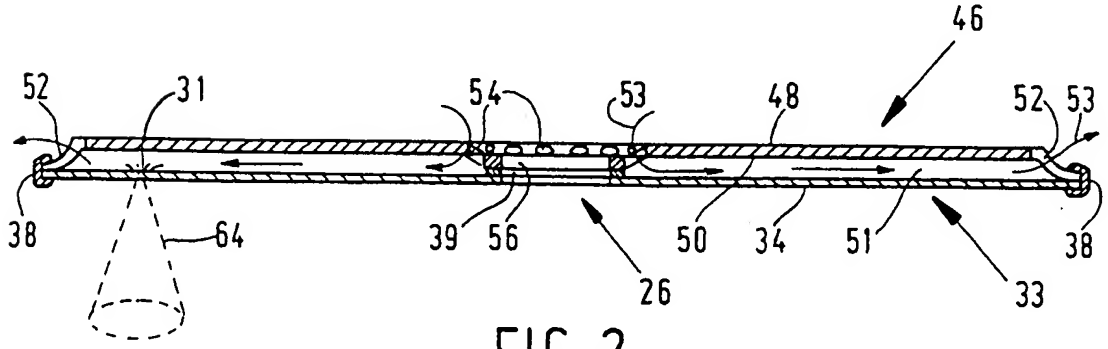

FIG. 2

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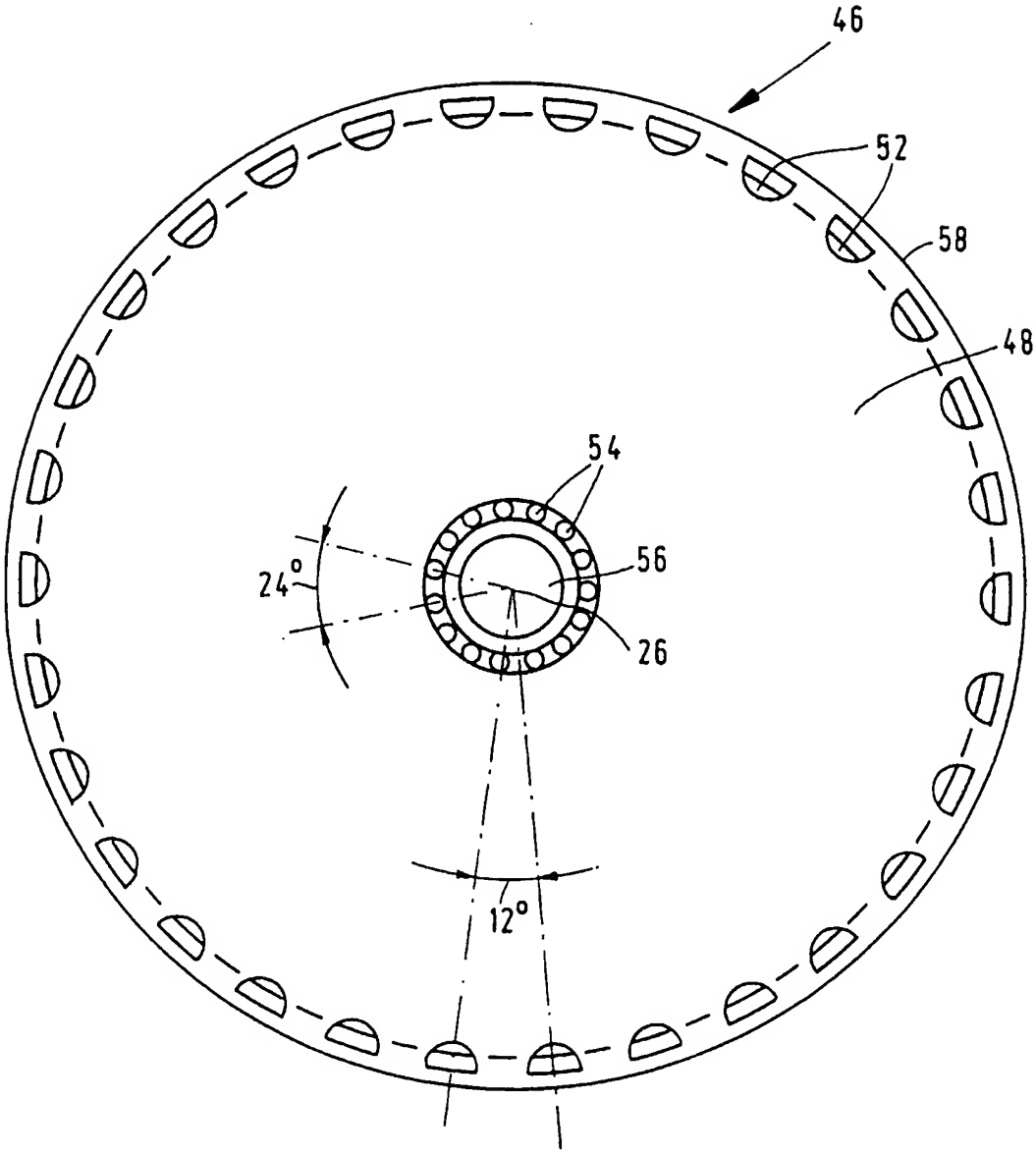

FIG.3

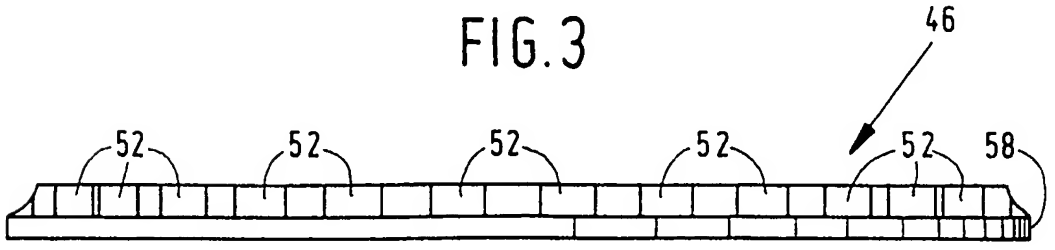

FIG.3a

7/21/06, EAST Version: 2.1.0.11

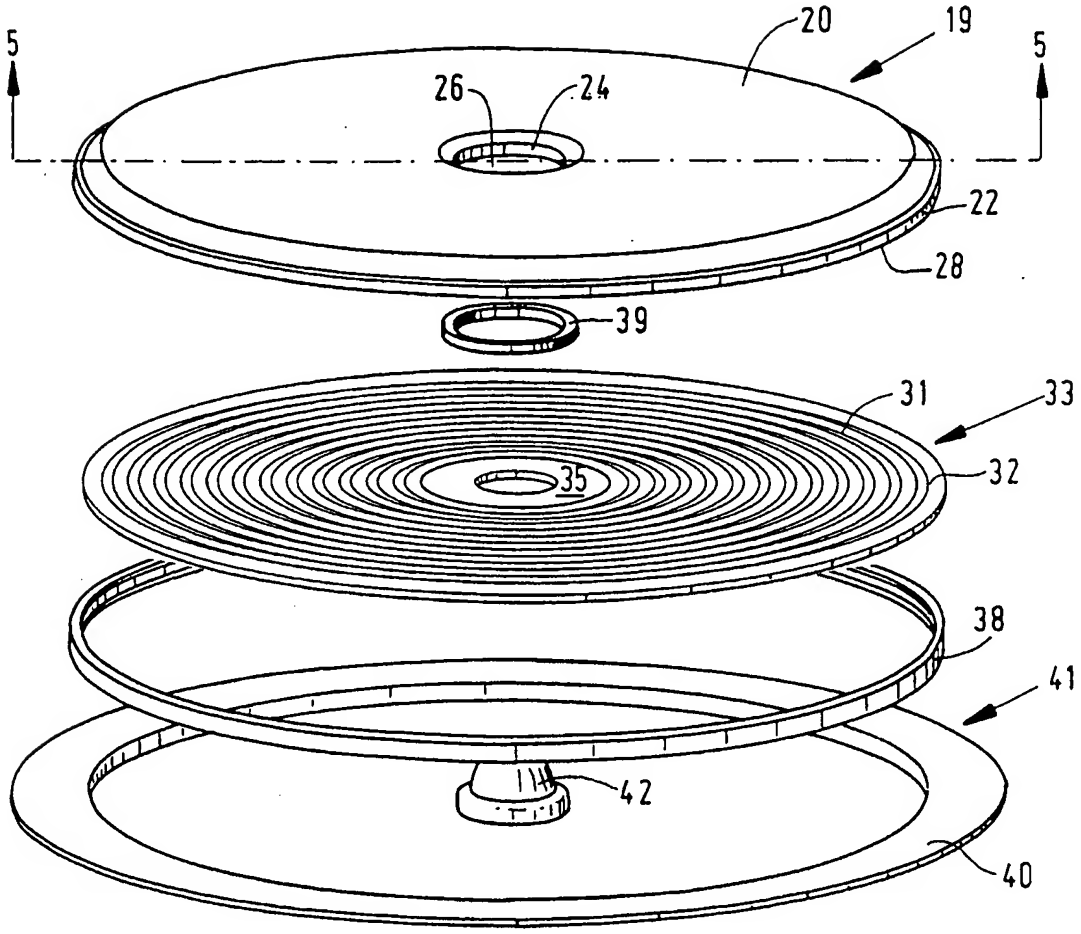

FIG. 4

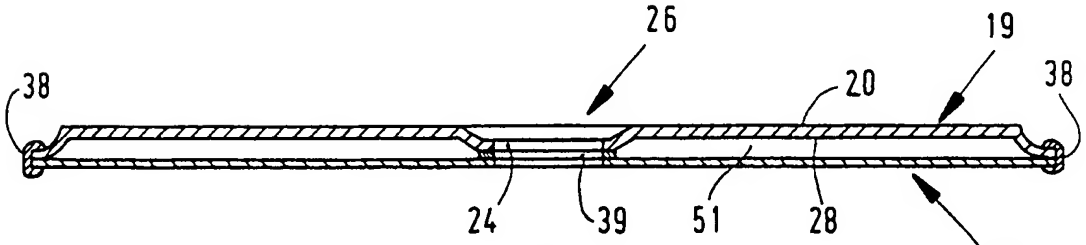

FIG. 5

7/21/06, EAST Version: 2.1.0.11

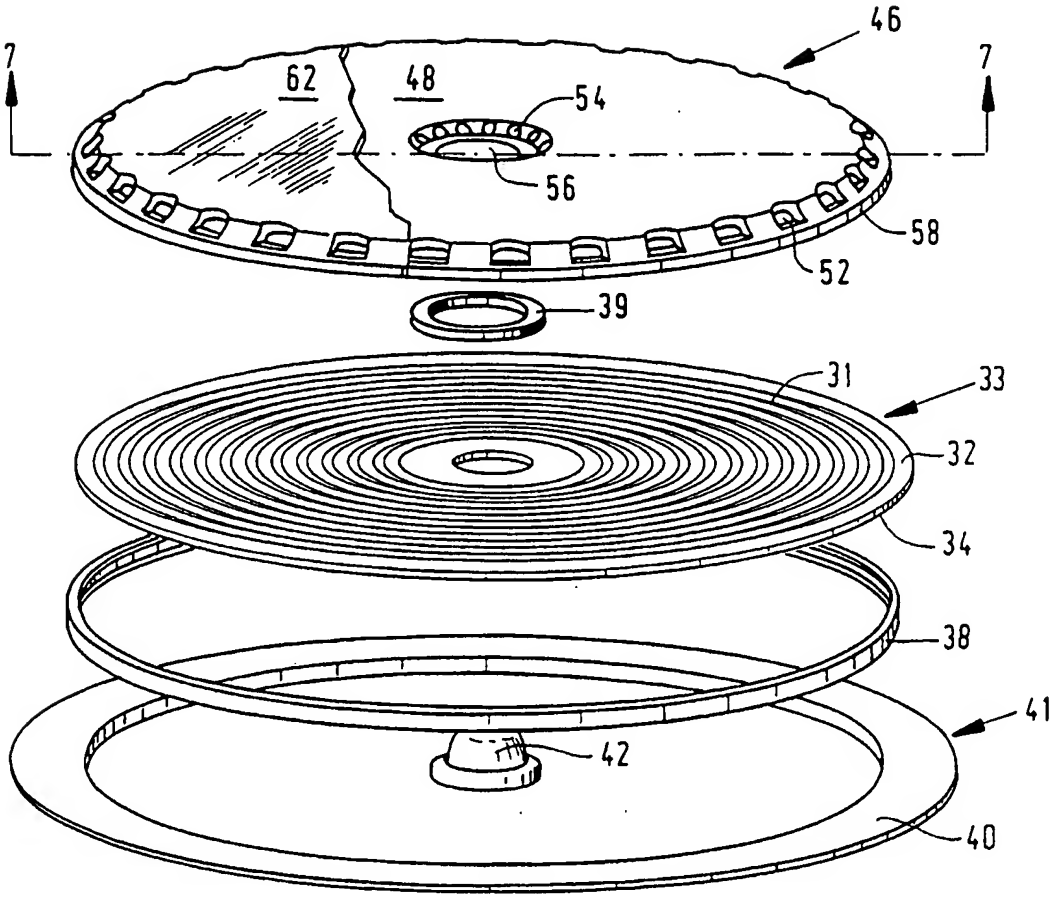

FIG. 6

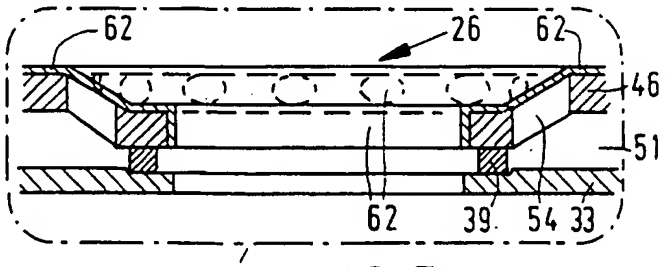

FIG. 7a

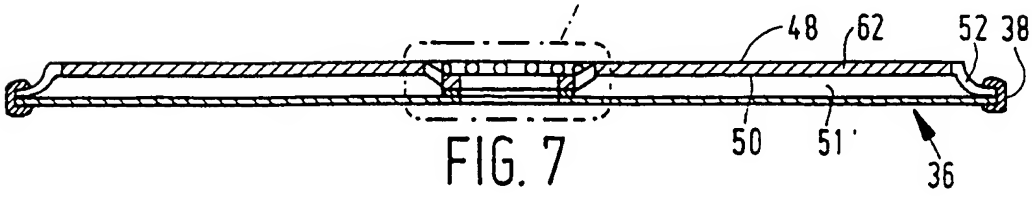

FIG. 7

7/21/06, EAST Version: 2.1.0.11

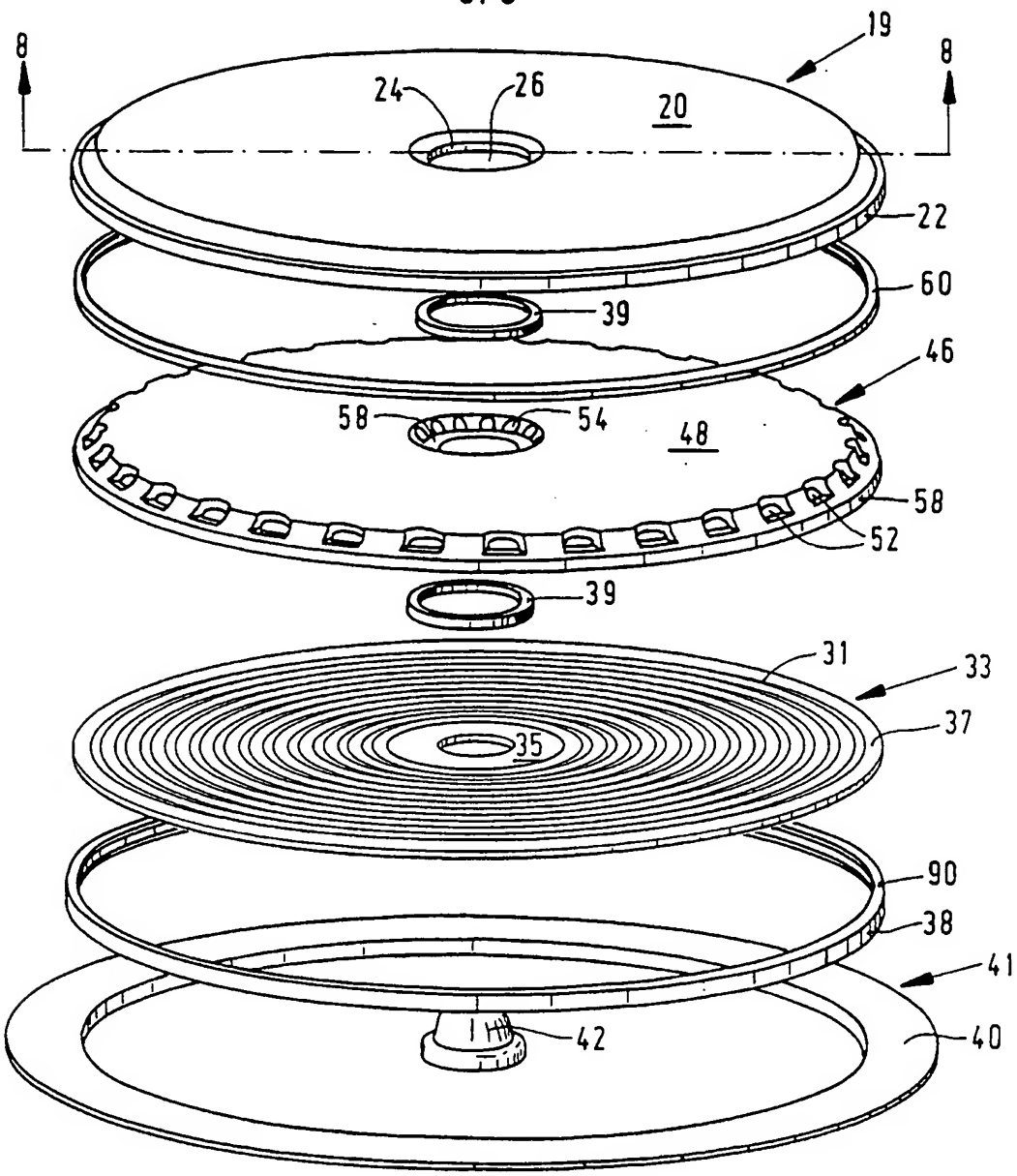

FIG. 8

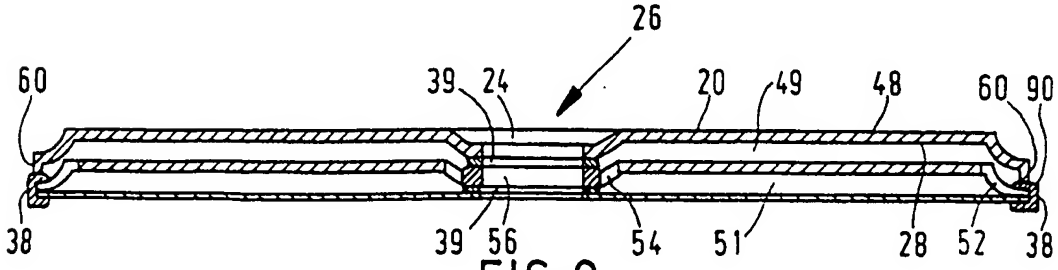

FIG. 9

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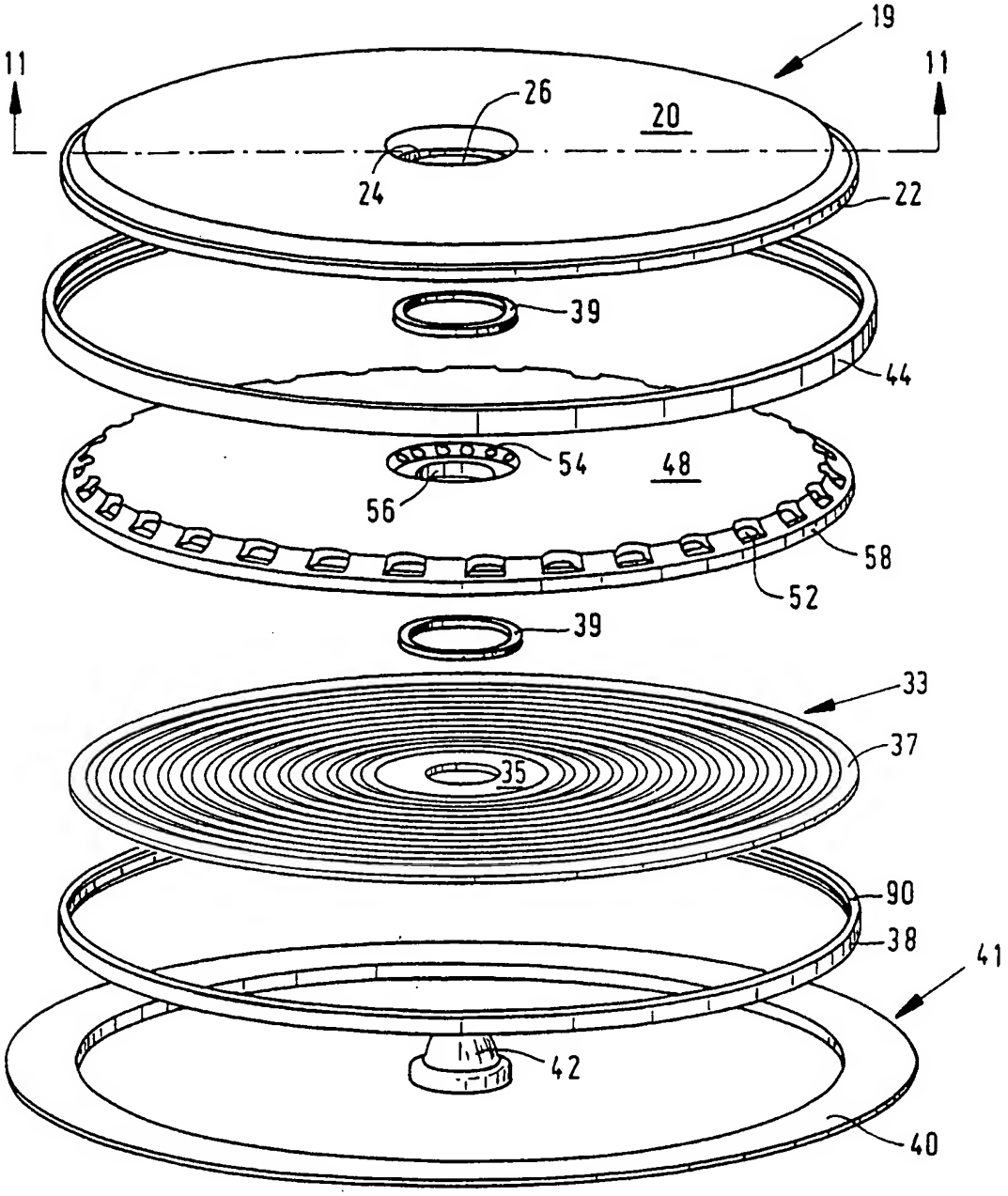

FIG. 10

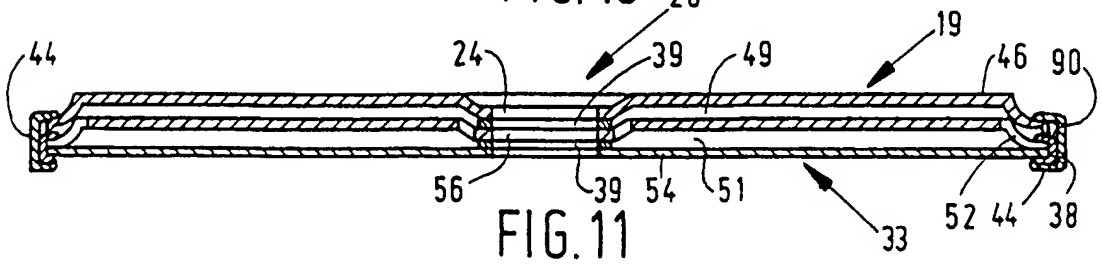

FIG. 11

7/21/06, EAST Version: 2.1.0.11